

of it as a hydrochloric acid waste. Instead, for both economic and environmental reasons, the plant installed a \$16 million conversion unit to produce chlorine from this by-product. The chlorine is reused in the "Freon" manufacturing operation—that's 315 million pounds per year of chlorine. Incidentally, the hydrogen which evolves is piped to the boilers and burned safely as fuel.

2. At our Edge Moor, Delaware, plant we manufacture titanium dioxide pigment. A by-product from this operation is a significant quantity of aqueous iron chloride. In the past, this material was barged to sea for disposal. As a result of R&D and engineering efforts, this material has been upgraded so that it can be used by water and wastewater treatment facilities as a coagulant. Marketing efforts have resulted in the sale of 65–75 thousand tons per year.
3. At our Victoria, Texas, plant, where we manufacture numerous intermediates for synthetic fibers, significant quantities of nonchlorinated hydrocarbons are generated as waste. Typically, these solvents had been burned in two incinerators on the plant. While this method did destroy the waste, and was environmentally sound, it was costly. Today, the incinerators have been dismantled and these solvents are being burned in our powerhouse to generate steam for the manufacturing process. Last year alone, the plant saved more than \$10 million in fuel oil costs by burning these wastes as fuel.

It is interesting to note that while all of the examples I have cited result in waste reduction, different techniques are employed. There was better utilization of the primary raw material resulting in an improved yield of polyethylene, and less waste. Chlorine was generated from a by-product of the original Freon manufac-

turing operation. It is recycled back to the beginning of the process as a raw material. Both of these examples are considered reduction of wastes at the source and at the same time they can be termed recycling of materials.

In the ferric chloride example in the past, we had disposed of this material as a waste. We have converted it to a co-product: In the Victoria example we have also taken material, which was being disposed of as a waste and directed it to a beneficial purpose—a fuel source. While these cases do not return material to the primary process, they still meet our stockholder and societal obligations. We are no longer discarding a resource.

In addition to accepting the challenge associated with waste reduction at the source, Du Pont believes government should share in the effort by designing regulations so that they encourage sound environmental practices to minimize waste generation. I would like to highlight two areas where this is not the case.

First—the definition of solid waste in the regulations is such that many facilities recycling hazardous materials would be required to obtain RCRA permits. One result will be significant increases in costs due largely to the administrative workload for no improvement in our ability to protect the environment. Another result will be the public perception that this beneficial recycling constitutes disposal of waste, when just the opposite is true.

Second—flammable solvents, which are by-products of a process, are classified as a hazardous waste. Due to this classification, the freight cost for such materials is significantly higher than it is on the incoming solvent—which, in many cases, has essentially the same hazard. The original producer must also have a RCRA permit before he can receive and purify these materials for reuse. This inhibits recycle or reuse of solvents by adding an unnecessary administrative burden.

Although the intent of the regulations is good, I question whether they in fact

promote implementation of a national policy to minimize waste generation. *If we truly seek to encourage implementation of programs designed to reduce generation of waste, we should make it more attractive to conduct recycle or reuse activities which benefit the environment and the economy.*

Industry's responsibility with respect to waste reduction is multifaceted. We have a responsibility to continue to improve our processes and operations so that waste reduction results in improved earnings for our stockholders. More importantly, we have a responsibility to the society in which we operate to protect the environment while continuing to improve the American standard of living. If American industry is to discharge these responsibilities, the

challenge is to create an organizational commitment to this effort and a working culture which fosters sensitivity and knowledge of the issue at all levels in the organization. I believe this challenge has been accepted within Du Pont and within American industry. As a result, we will see considerable reductions in the percentage of waste generated per pound of product produced, just as we have seen reductions in the consumption of energy over the last 10 years. In order to improve upon this effort, we must continually modify the way we operate. Perhaps Peter Drucker, the business consultant, put it best when he said . . . "the only means of conservation— is innovation."

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Biological Diversity and Development: A Legal Perspective

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The goal of economic development, whether within an industrialized nation like the United States or the mostly rural nations of the Third World, has often been perceived to be at odds with that of environmental protection. That perception, which causes trouble enough here, where the common aspiration is to make a very good standard of living even better, presents an immense challenge elsewhere, where many aspire only to improve upon a bare subsistence standard of living. That

challenge is even more difficult when the environmental resources at stake are not clean water needed for human consumption or productive soils for crops, but rather living wild species offering no immediate, discernible benefit to human welfare.

Despite this troubling perception, the scientists on this panel and elsewhere assure us that, in fact, the advancement of human welfare and the protection of biological diversity are intimately bound together. Indeed, the prospects for long-term,

sustainable development depend in part on our ability to refrain from unraveling the intricate web of life in which we ourselves are placed. This is because living wild resources are the reservoir from which we will need to draw many of our future discoveries in medicine, agriculture, and industry. It is also because collectively they perform a myriad of ecological services, from storm water retention and pollutant consumption to photosynthesis itself, that are essential for our well being.

If we assume the scientists are right, two clear imperatives emerge. One is to enact laws and design and implement programs for the conservation of biological diversity. There are several such laws and programs in the United States. Perhaps the best known of them is the federal endangered species program spawned by the Endangered Species Act of 1973.

The Endangered Species Act has often been described—both in the United States and elsewhere—as model legislation for the rest of the world. Its stated goal, quite simply, is to prevent the avoidable extinction of wild plants and animals. The means it uses to attain this goal include prohibitions on hunting and trade, the acquisition and protection of important habitat, and a rather novel command to federal government agencies that none of their actions jeopardize the survival of any threatened or endangered species. These are the familiar tools with which legislators have long attacked wildlife conservation problems—prohibitions, commands, and public expenditures for land acquisitions.

How well have these familiar tools fared in the effort to prevent the extinction of species? There are, most assuredly, some signal successes. Two that you may see near here are the American alligator and the brown pelican. Restrictions on hunting have enabled the former to recover, while the latter, along with the bald eagle, and peregrine falcon, owes its recent resurgence to the elimination of DDT and other persistent pesticides. These examples illustrate the very important point that

the road to extinction can be reversed and that this can be done without significantly retarding or affecting economic growth.

At the same time, however, the limits of what can be achieved through such conservation programs are becoming increasingly apparent. Today, nearly 400 species of plants and animals in the United States enjoy the protection of the Endangered Species Act. Yet more than twice the number have been identified as needing the Act's protection, but still await the slow process of adding them to the protected lists. Many of these have declined dramatically while awaiting the Act's protection; some have disappeared altogether. Even for species that have long benefitted from the Act's protection, survival has not been guaranteed. Three of the best known of these, three species that have been protected since the very inception of the endangered species program, are closer now the brink of extinction than ever before. The California condor, of which perhaps three dozen birds still survived in the late 1970's is now down to only five or six birds in the wild. The black footed ferret had one known population with nearly 130 animals in it in 1984; now perhaps no more than three animals survive in the wild. Finally, right here at Disney World, the last two specimens of the dusky seaside sparrow—both males—await the certain end of their species. Add to these specific examples the general problem of inadequate funds for habitat acquisition and other recovery efforts, and one can better understand why the model conservation legislation we so often tout here is unlikely to stem the torrent of species losses now occurring in much of the rest of the world.

If conservation laws and conservation programs, by themselves, are not sufficient to serve the goal of preserving biological diversity, what then is the second imperative in order to heed the scientists' warning that development, to be sustained, must ensure the protection of biological diversity. The answer, I think, is that the full force of our intellectual efforts must be given over, not to decrying the

adverse environmental effects of development, but to promoting development in ways that reduce both social and environmental costs. To assure you that this is more than just an abstraction, let me offer one current, concrete example from within my own organization.

Southern California, as most of you know, has the unusual characteristics of being very dry and very populous. The region's potential for growth depends upon the availability of water. Historically, to supply water to the burgeoning populations of Los Angeles and other metropolitan areas, the region looked east to the Colorado River and north to the scenic rivers of northern California. Dams and diversions drastically altered the environments and the diversity of many of these rivers. Today, growth and the thirst for still more new sources of water continue.

At the same time, between Los Angeles and San Francisco, a new problem has come to be recognized within the last few years. Through irrigation, the normally arid San Joaquin River Valley has become one of the most productive agricultural regions in the country. But because of the area's geology, irrigation water becomes trapped near the surface unless drained by subsurface tiles. These tiles carry the drained water through conduits that eventually empty into the large evaporating ponds that comprise the Kesterson National Wildlife Refuge. About two years ago, people began to notice serious abnormalities and high mortality among the waterfowl using the Refuge. The cause, it was determined, was selenium, a trace element being leached from the soils of the San Joaquin River Valley by irrigation water.

The impulse that has perhaps become too common in the environmental movement was to recommend the drastic step of cutting off irrigation water to the valley—drastic, because it would put an end to agriculture itself in the region. Some environmentalists recommended exactly that. But we at the Environmental Defense Fund searched for a positive alternative that might solve the problems of

both the waterfowl at Kesterson and the fisheries and other wildlife of the northern California rivers being eyed for future dams.

What we have recommended is that the irrigation wastewater be collected and treated in reverse osmosis desalting plants, and the resulting brine placed in solar ponds for electricity production. The technologies for both of these processes are recent and tested, though on a smaller scale than envisioned here. The products of these processes are clean water and electricity and a concentrated waste that can be more easily and safely disposed of. Because the irrigators are the beneficiaries of the long-term, low-cost federal water supply contracts, they could, at a substantial profit, sell the reclaimed water to Los Angeles for less than the city would have to pay for the same amount of water from new dams. One of the jobs for our lawyers has been to persuade the federal government that water it supplies to irrigators can lawfully be resold in this way. Assuming those institutional hurdles can be cleared, the net result is that Los Angeles can meet its immediate water supply needs without building more dams, productive irrigated agriculture can continue in the San Joaquin River Valley, and the waterfowl of the valley cease to be threatened by the hazard of selenium. In short, the goals of development and protection of wildlife and the environment can both be served.

The challenge facing all of us concerned about biological diversity and development is to multiply examples like this both in the United States and in the rest of the world. Often, as in the example cited, novel technologies will be needed and, equally often, the legal challenge of adapting institutions to facilitate those novel technologies will be essential. In this way, we can perhaps begin to change the perception that the goals of economic development and environmental protection are at odds. By changing that perception, the objective of preserving biological diversity embodied in our conservation laws and programs will gain important allies.

Zoological Parks and Aquariums—Bridges of Learning

Lanny H. Cornell, D.V.M.

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Charles Lindbergh said “the Human Future depends on our ability to combine the knowledge of science with the wisdom of wildness” . . . nature. Wise words. It is evident from this gathering of respected leaders from state and Federal government, industry, academia and the environmental community, that we acknowledge and agree with the wisdom of this statement.

The richness and diversity of our natural resources promote a multitude of uses that are deserving of responsible stewardship. Technology has made many important advances and improvements for mankind through the manipulation of the physical and biological elements of our biosphere. And yet, new technology has brought with it some problems, i.e., atomic energy/nuclear war, pharmaceuticals/illegal drugs, chemicals/toxic wastes, space exploration/tragic accidents, and fears that genetic engineering will bring us Aldous Huxley’s “brave new world.” But the benefits of technology overcompensate for the negatives. And because progress is an on-going process, we must continue to monitor existing programs, increase our research capabilities, and where necessary, make programmatic readjustments. We must prove that technology is not poison.

From experience, we at Sea World know

that constructive progress can best be made in an atmosphere of mutual concern and cooperation. The Charles A. Lindbergh Symposium “Technology and Environment: The Search for Balance,” is a timely and important dialog on this important subject. It is my hope that this and other forums of its kind will be successful in promoting a thoughtful, cooperative and constructive discussion of the important promises that science and technology hold for the world in 1986 and beyond. Let us interrelate our areas of expertise and work with one another . . . collectively, to develop safe, new technologies. We must never give up our hopes of understanding and improving our world . . . in striking a balance.

Zoological parks and aquariums in the U.S. have an abiding interest in the implementation of Charles Lindbergh’s philosophy. We approach this from a standpoint of providing to the public education, recreation and cultural enjoyment through the scientific study and conservation of wildlife. In this way we endeavor to promote a greater awareness, understanding, and appreciation of wildlife and their environment. We do this with the hope of contributing to a more informed and responsive citizenship in tomorrow’s technological society. At the same time our